JPL Future Mission Outlook

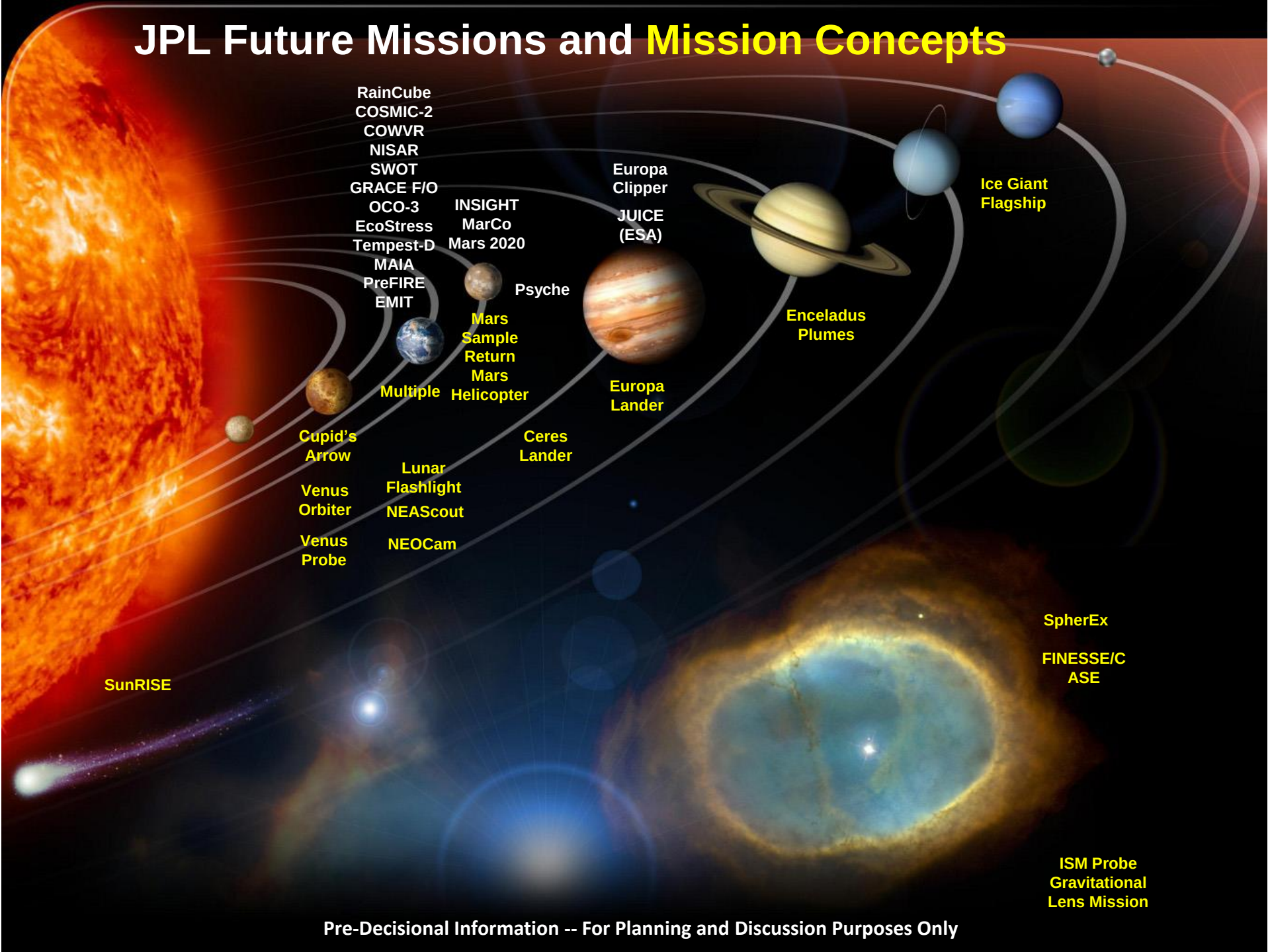
Jet Propulsion Laboratory
California Institute of Technology

JPL Commercial Space Engagement: Beginning a Cultural Exchange

March 14, 2018

Tony Freeman,
Manager, Innovation Foundry
NASA Jet Propulsion Laboratory
California Institute of Technology

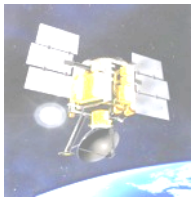
JPL Future Missions and Mission Concepts



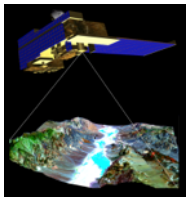
Pre-Decisional Information -- For Planning and Discussion Purposes Only

JPL Earth Science Flight Projects

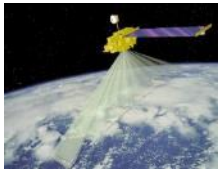
Operational



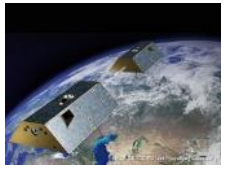
QuikSCAT
(1999)



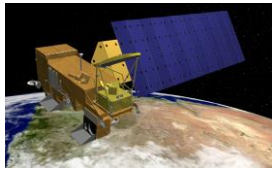
ASTER
(1999)



MISR
(1999)



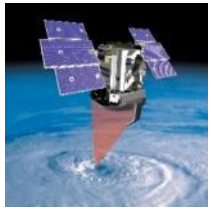
GRACE
(2002)



AIRS
(2002)

TES
(2004)

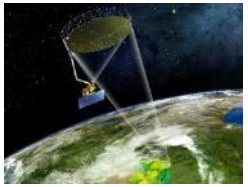
MLS
(2004)



CloudSat
(2006)

Ocean Surface
Topography Mission
(2008)

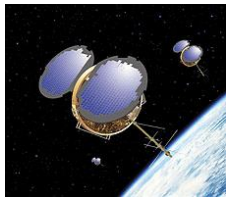
Carbon Cycle: OCO-2
(2014)



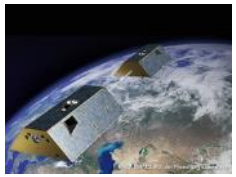
Soil Moisture: SMAP
(2015)

Jason 3[1]
(2016)

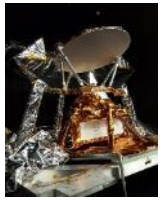
Future



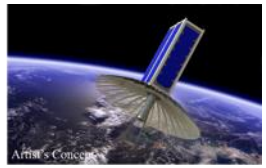
COSMIC-2 A/B[1][2]
(2017/2018)



GRACE-FO
(2017)

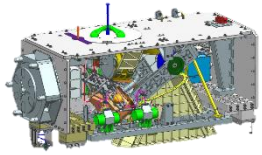


COWVR[2]
(2017)



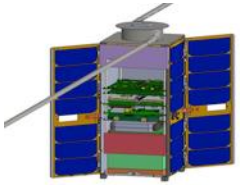
RaInCube (2018)

OCO-3
(2018)

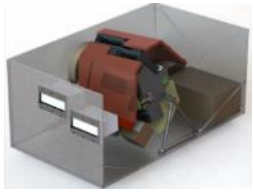


ECOSTRESS
(2018)

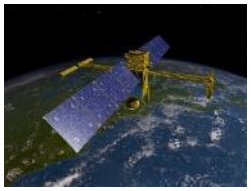
TEMPEST-D
(2018)



HF Research
(DHFR) Testbed[3]
(2018)

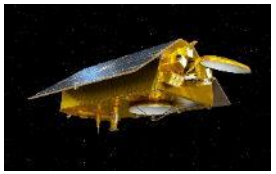


MAIA
(2019+)



SWOT
(2021)

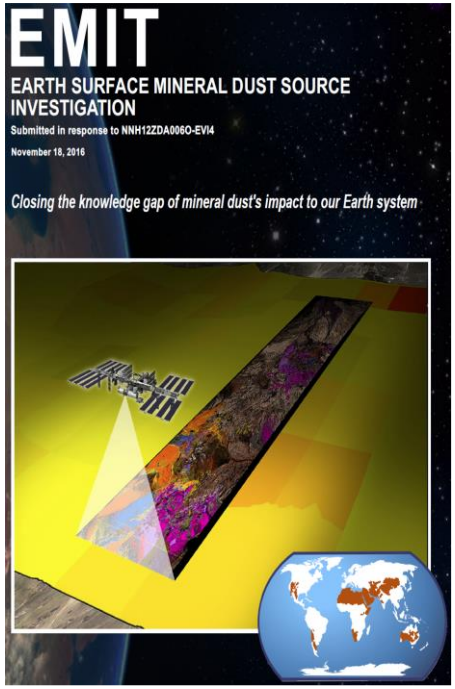
NISAR
(2021)

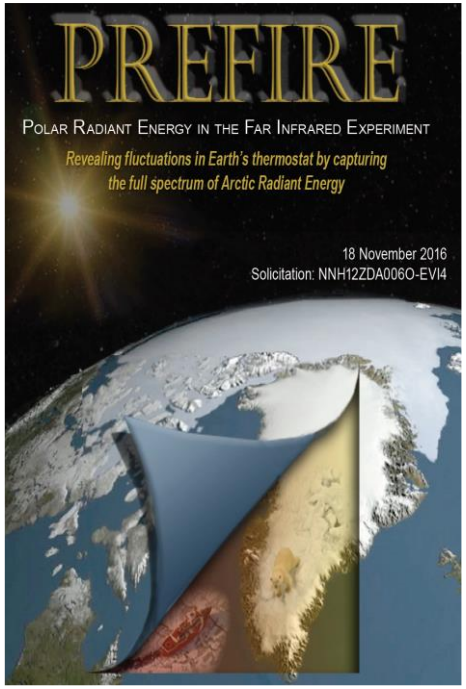


Sentinel 6
(2020/2025)

Pre-Decisional Information -- For Planning and Discussion Purposes Only

JPL Earth Science Flight Projects

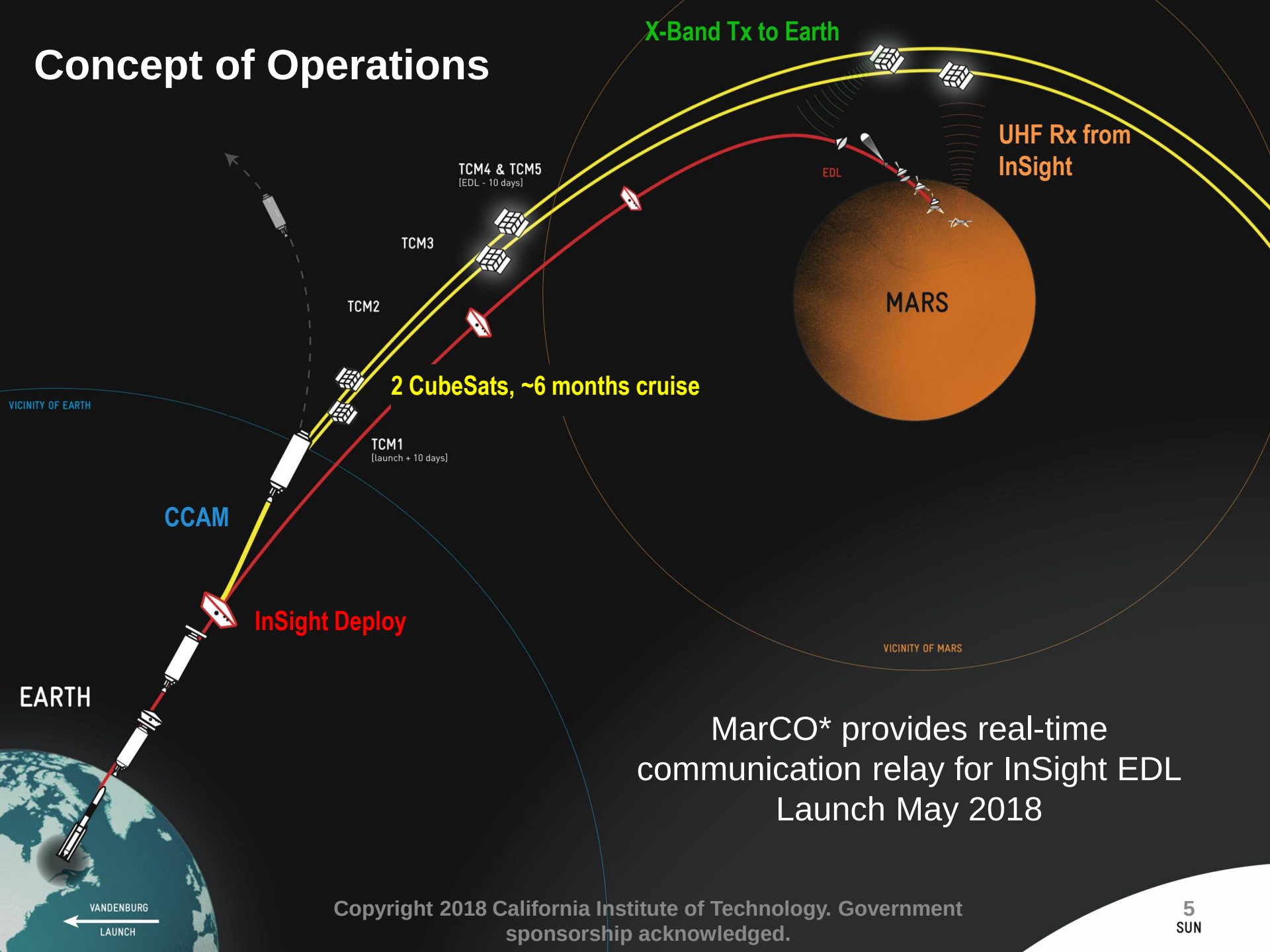




Recently Selected Flight Projects

Decadal Survey for Earth Science and Applications from Space (2018)

Concept of Operations

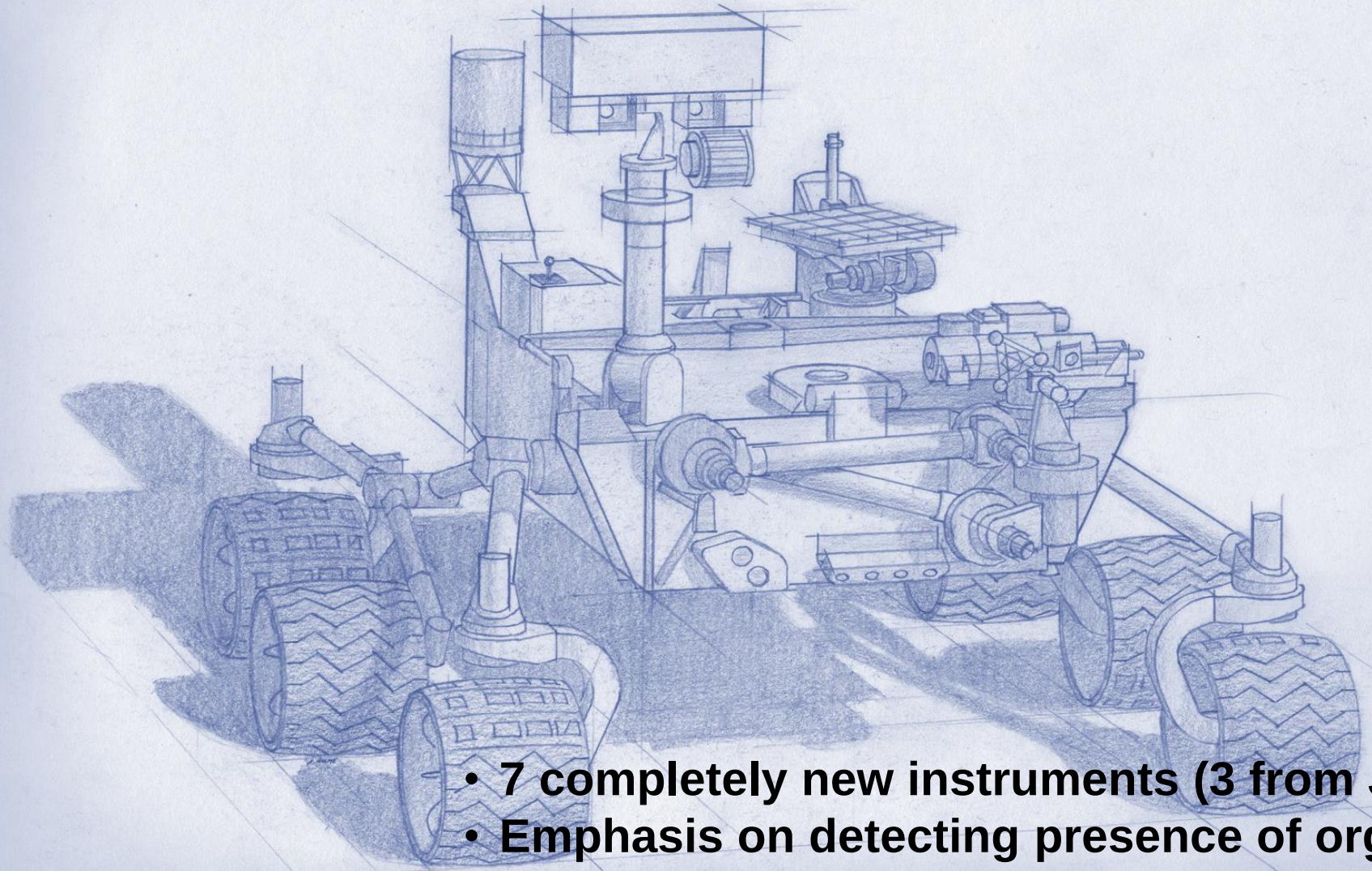


MarCO* provides real-time communication relay for InSight EDL
Launch May 2018

SUN

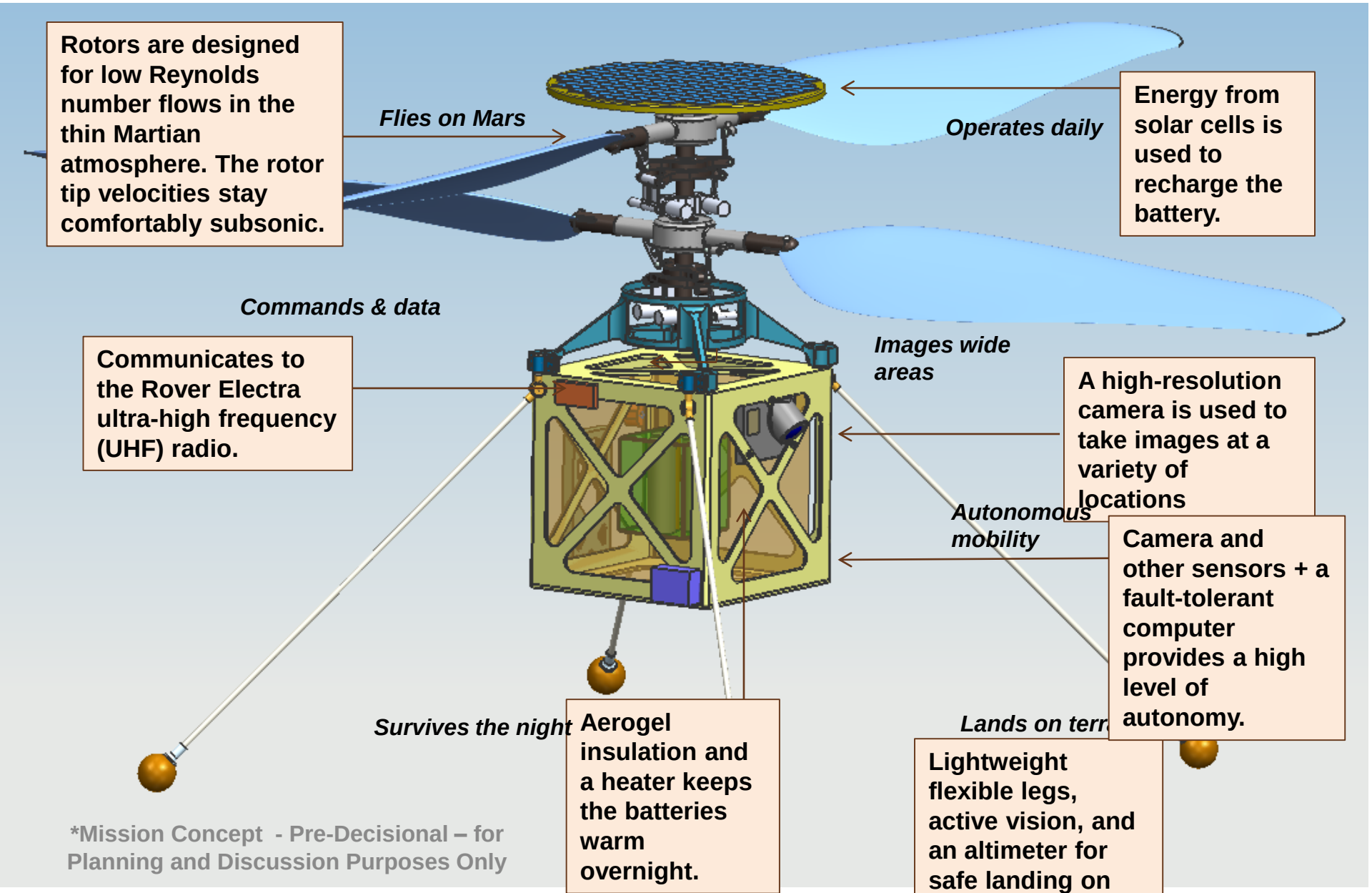
Mars 2020 Rover

- Same chassis as Curiosity (2012)
- Same “terrifying” skycrane landing system



- 7 completely new instruments (3 from JPL)
- Emphasis on detecting presence of organics

Mars Helicopter (under Investigation)



Mars Exploration Program

In Development

Concept Studies & Tech Maturation for Earth Return

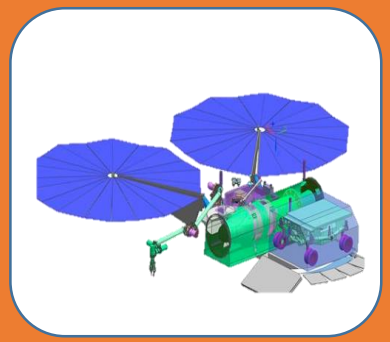
Mars 2020

- Acquire Samples on Mars
  - Launch from Earth/Land on Mars
  - Select Samples
  - Acquire/Cache Samples

Sample Caching Rover (Mars 2020)

Sample Retrieval/ Launch into Mars orbit

- Retrieve/Package Samples on Mars



Mars Sample Retrieval Lander

Orbiter

- Capture and Isolate Sample Container
- Return to Earth
- Land on Earth

Mars Sample Return Orbiter

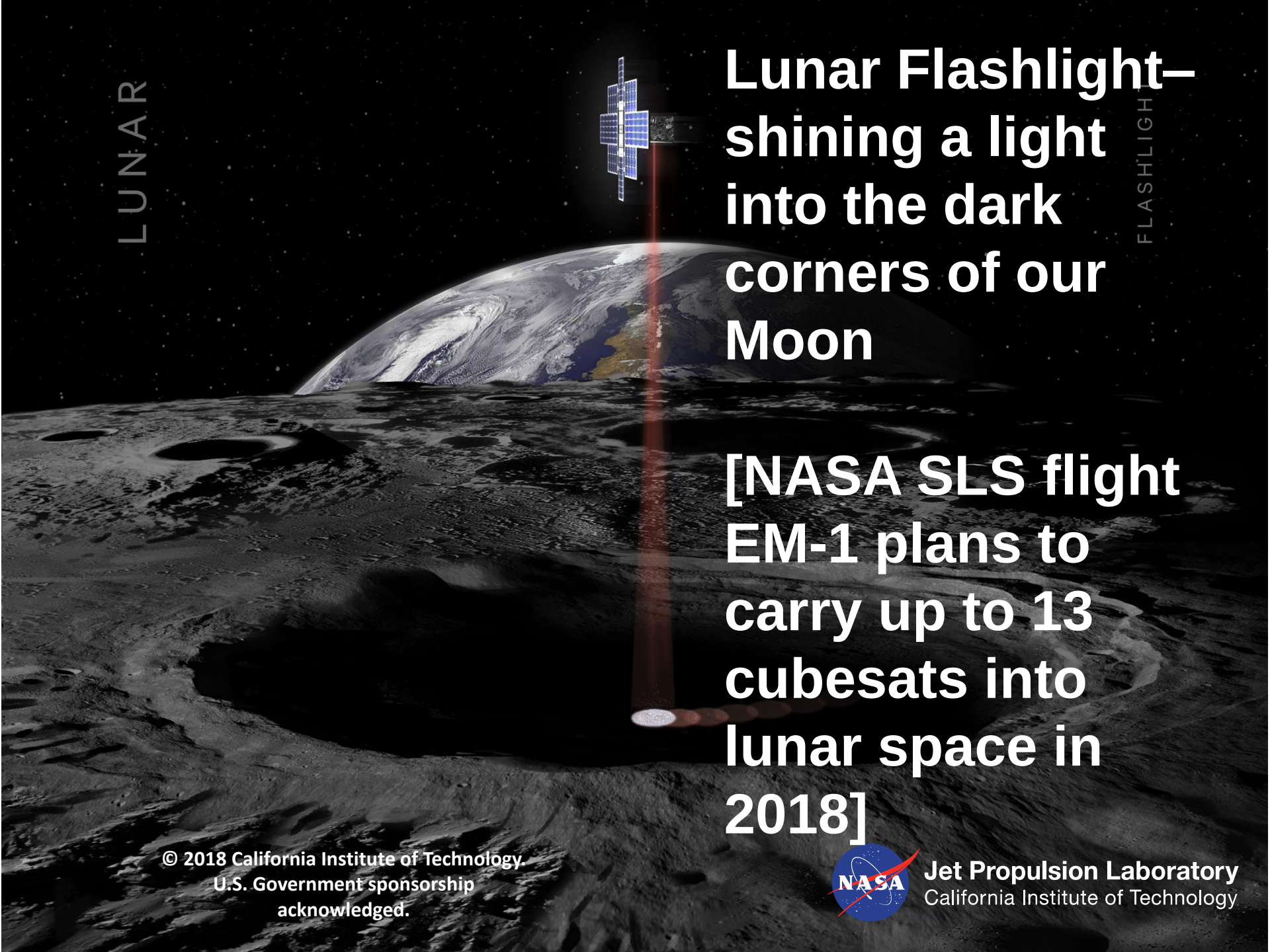
Mars Returned Sample Handling

- **Retrieve/quarantine landed EEV**
- **Transport to Sample Receiving Facility**

Sample Receiving Facility

Flight Elements

Ground Element



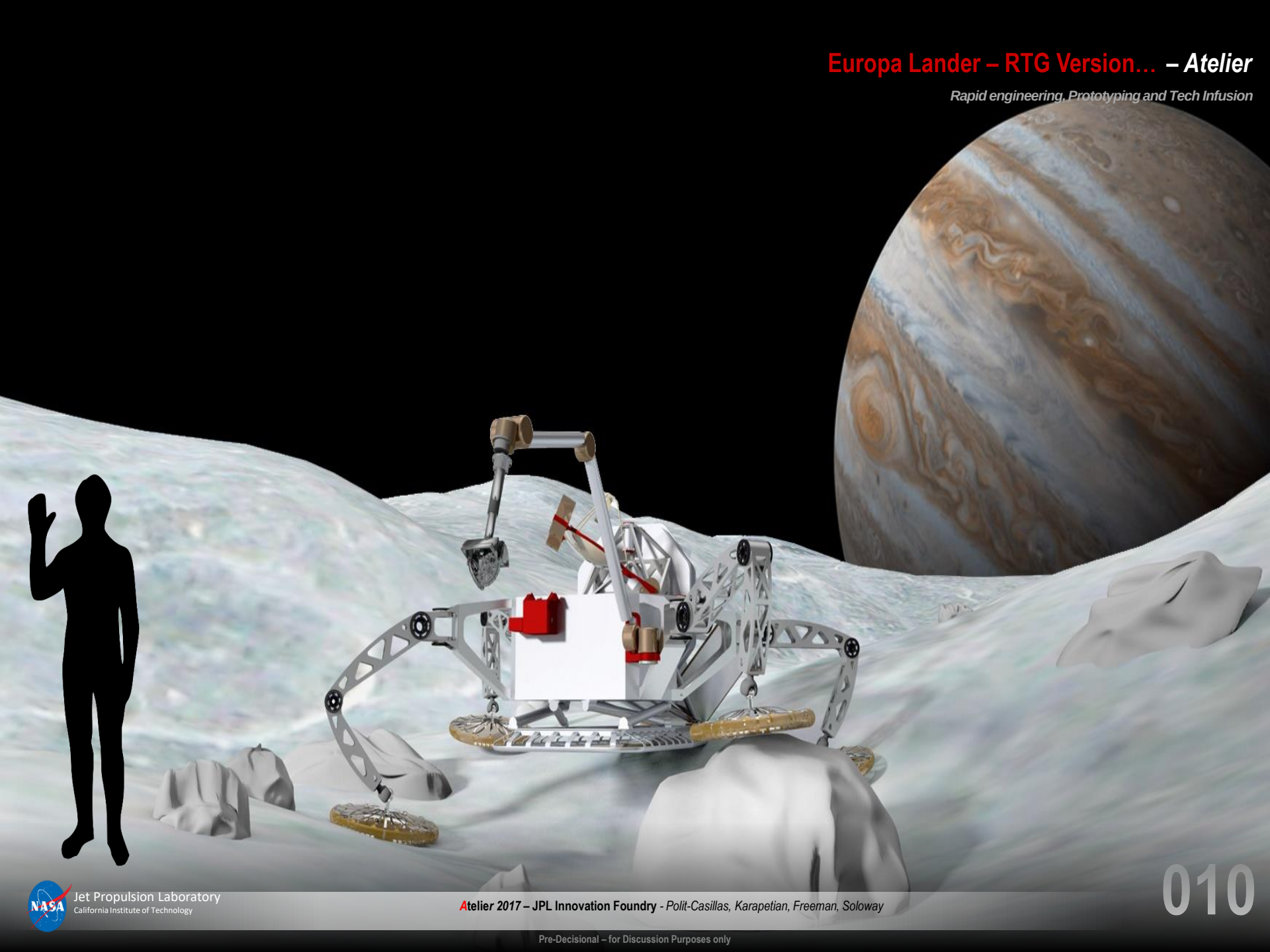
Lunar Flashlight– shining a light into the dark corners of our Moon

[NASA SLS flight EM-1 plans to carry up to 13 cubesats into lunar space in 2018]

Jet Propulsion Laboratory
California Institute of Technology

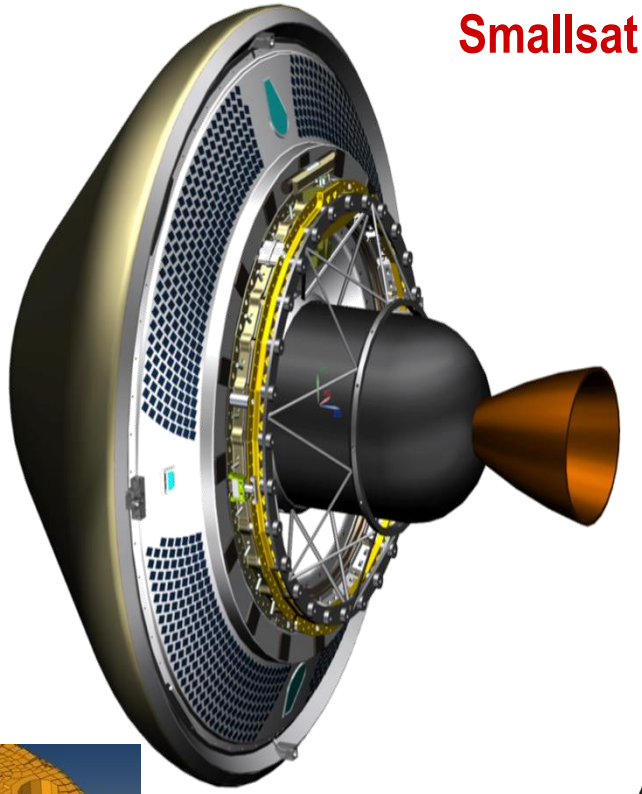
Europa Lander – RTG Version… – *Atelier*

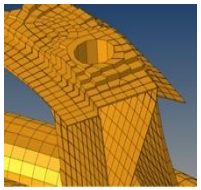
Rapid engineering, Prototyping and Tech Infusion

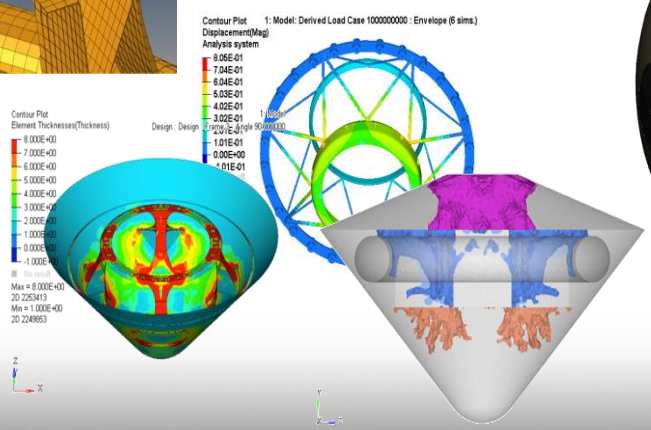


Smallsat Probe to sample Venus' Atmosphere - Cupid's Arrow

Rapid engineering, Prototyping, Tech Infusion and Method Development



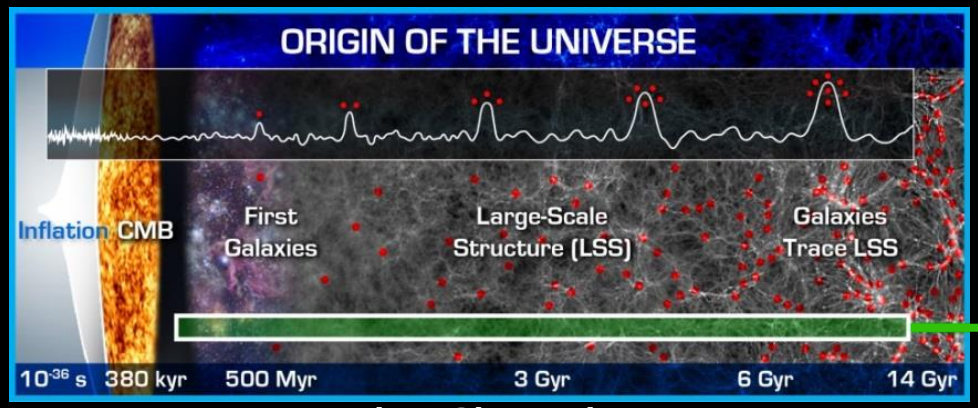




	Quantity	Component Mass CBE Each	CBE Total	Contingency	CBE+Cont	Subsystem	System	Component Power Max	Nominal	Idle	Contingency	Deployment	Cruise	Downlink	Maneuvering	Aeropass	Processing
Payload							6.07 kg										
Instrument	1					5.20 kg		20.0 W	0.0 W	0.0 W	30%	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W	m 26.0 W
Chamber+Mass spec	1	1.85 kg	1.85 kg	30%	2.41 kg												
Pump	1	1.40 kg	1.40 kg	30%	1.82 kg												
Electronics	1	0.75 kg	0.75 kg	30%	0.98 kg												
Sample Handling						0.51 kg											
Valves	9	0.025 kg	0.23 kg	5%	0.24 kg			2.0 W	0.0 W	0.0 W	30%	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W
Instrument valve manifold	1	0.190 kg	0.19 kg	43%	0.27 kg												
Intake manifold backplates	3																
Sample Tanks	3																
Resonant Tank	1	0.10 kg	0.10 kg														
Calibrant Tank	1	0.10 kg	0.10 kg														
Camera	1	0.05 kg															m 1.3 W
ADCS																	
Sun Sensor (SolarMems D60)	4	0.01															W n 0.5 W
SIP ST16 Star Tracker	2	0.1															0 W i 0.0 W
IMU	1	0.1															5 W n 3.5 W
CDH	1																9 W m 4.4 W
Sphinx Cubesat Board	1	0.12 k															
EPS Card	1	0.12 kg															
Mission Interface Card	1	0.12 kg															
EPS							6.42 kg										
Batteries	90	0.05 kg				20 kg											
Lightband upconverter	1	0.10 kg				0.14 kg		1.5									i 0.0 W
Motor driver board	1	0.20 kg				0.26 kg		0.5 W									i 0.0 W
Shell solar cells	984	0.00048 kg				0.61 kg											
THR							0.73 kg										
Cold Gas ACS						0.73 kg											
3 valv		0.11 kg				0.24 kg		0.2 W									i 0.0 W
1		0.04 kg				0.12 kg		0.2 W									i 0.0 W
		0.05 kg				0.12 kg		0.3 W									n 0.8 W
		0.08 kg				0.17 kg											
		0.03 kg				0.07 kg											
		0.00				0.00 kg											
							27.60 kg										
						9.08 kg	9.08 kg										
						2.75 kg	2.75 kg										
							2.33 kg										
						0.57 kg											
						0.40 kg		2.0 W									0.0 W m 24.0 W i 0.0 W
						1.30 kg											
						0.02 kg											
						0.04 kg											
						0.87 kg											0 W i 0.0 W i 0.0 W
																	i 0.0 W n 11.0 W
																	0.0 W n 15.0 W
							60.84 kg										
							66.66 kg										
							25.14 kg										
						19.56 kg											
		4.18 kg		5%	4.39 kg												
		14.45 k		5%	15.17 kg												
Suppor						5.58 kg											
SRM		2.0		15%	2.30 kg												
Lightband	1	0.8		5%	0.87 kg												
Lightband Lo	1	2.2		5%	2.40 kg			76.0 W	0.0 W	0.0 W	15%	m 87.4 W	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W	i 0.0 W
OVERALL							91.80 kg					41.9 W	32.6 W	59.7 W	39.7 W	30.1 W	62.4 W

Jet Propulsion Laboratory
California Institute of Technology

SPHEREx:An all-sky infrared spectral survey



Time Since Big Bang

Time Since Big Bang

Stages of Star Formation

Selected for NASA MIDEX Phase A Study

Planned Launch in 2022

PI James Bock (CIT)

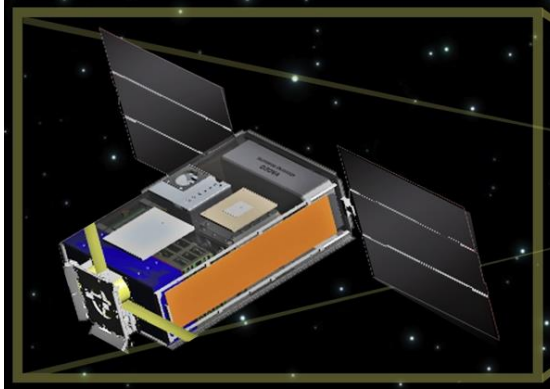
SunRISE: Revealing how energetic particles are accelerated and released into space

SunRISE selected for NASA Mission of Opportunity Phase A study

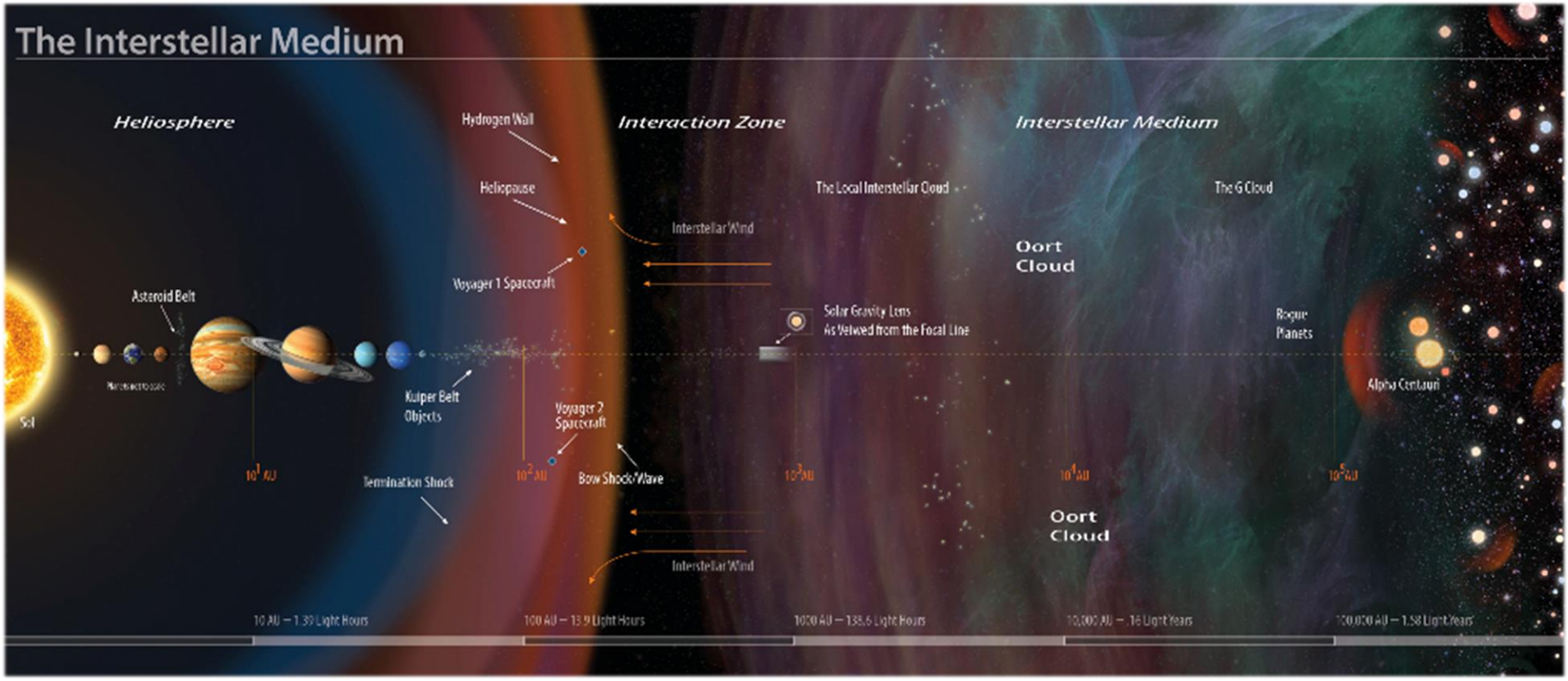
Six 6U constellation radio interferometer (0.1-25 MHz)

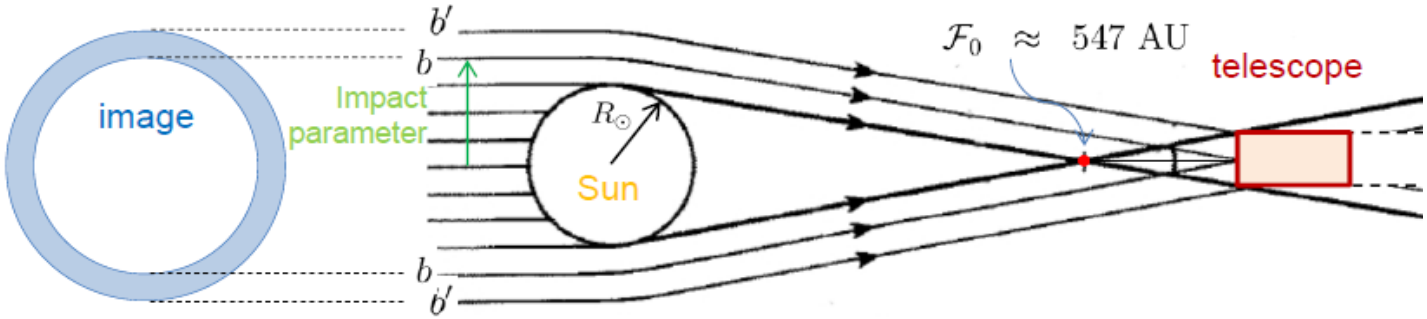
PI: Prof.Justin Kasper (U.Michigan)

Planned Launch in 2022



ISM Probe – Gravitational Lens Mission Concept





Leon Alkalai, Nitin Arora NASA-JPL